Prototype Measurements of Wave Run-Up on a Rubble Mound Breakwater

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Abstract

Physical processes such as wave run-up and wave overtopping are very important with regard to the design of sloping coastal structures. These are not yet fully understood. Preliminary prototype measuring campaigns (1993-1996) indicated clearly higher dimensionless wave run-up values (i.e. run-up values divided by the incident wave height) than the values found by laboratory testing and reported in literature.
Nowadays, the design of a breakwater's crest height is similar to the design method of dikes and is solely based on wave run-up values obtained by small scale model tests. Prototype measurements are seen as the big challenge to be addressed to verify the scale model test results. Therefore, a rubble mound breakwater protecting the outer harbour of Zeebrugge (Belgium) and armoured with 25 ton grooved cubes is fully instrumented to measure the sea state, wave run-up and wave overtopping. Extensive laboratory testing is carried out on two and three dimensional scale models. For a better determination of the wave run-up on the scale models, a novel step gauge is developed. Still, prototype wave run-up values are up to 20% larger than the values obtained by scale model tests. Dimensionless wave run-up values are also dependent on water depth: these increase from 1.80 at high tide to 2.25 at mean tide.